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•DISCOVER THE GIANTS OF THE PREHISTORIC WORLD•

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Your guide to...
PACHYRHINOSAURUS 721
ATLASCOPCOSAURUS 724
HAPLOCANTHOSAURUS 725

DINOSAUR WORLD

DINOSAURS FROM CHINA 726

SPOTTER'S GUIDE

THRILLING FRILLS 734

TIME DETECTIVE

Explore the desert in
EXPEDITIONS: MONGOLIA 736

HISTORY IN PICTURES

GIANTS OF AFRICA 740

A to Z

More dinos for your dictionary:
Monoclonius to *Nanosaurus* 744

ASK THE EXPERT

Cambridge University's Dr David Norman answers your dinosaur questions BACK COVER

PLUS

GIANTS OF THE PAST

Pachyrhinosaurus fends off *Daspletosaurus* 730

3-D Gallery

Take a step back in time to the Late Jurassic 732

DINO Fact File

Facts, figures and prehistoric brainteasers 742

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DINOSAURS! is published by
Orbis Publishing Ltd
Griffin House
161 Hammersmith Rd
London W6 8SD
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N31 93 11 04

Printed in Italy by Officine Grafiche De Agostini, Novara

PACHYRHINOSAURUS

***Pachyrhinosaurus* was almost as long as an elephant with a strange, bony bulge in the middle of its snout.**

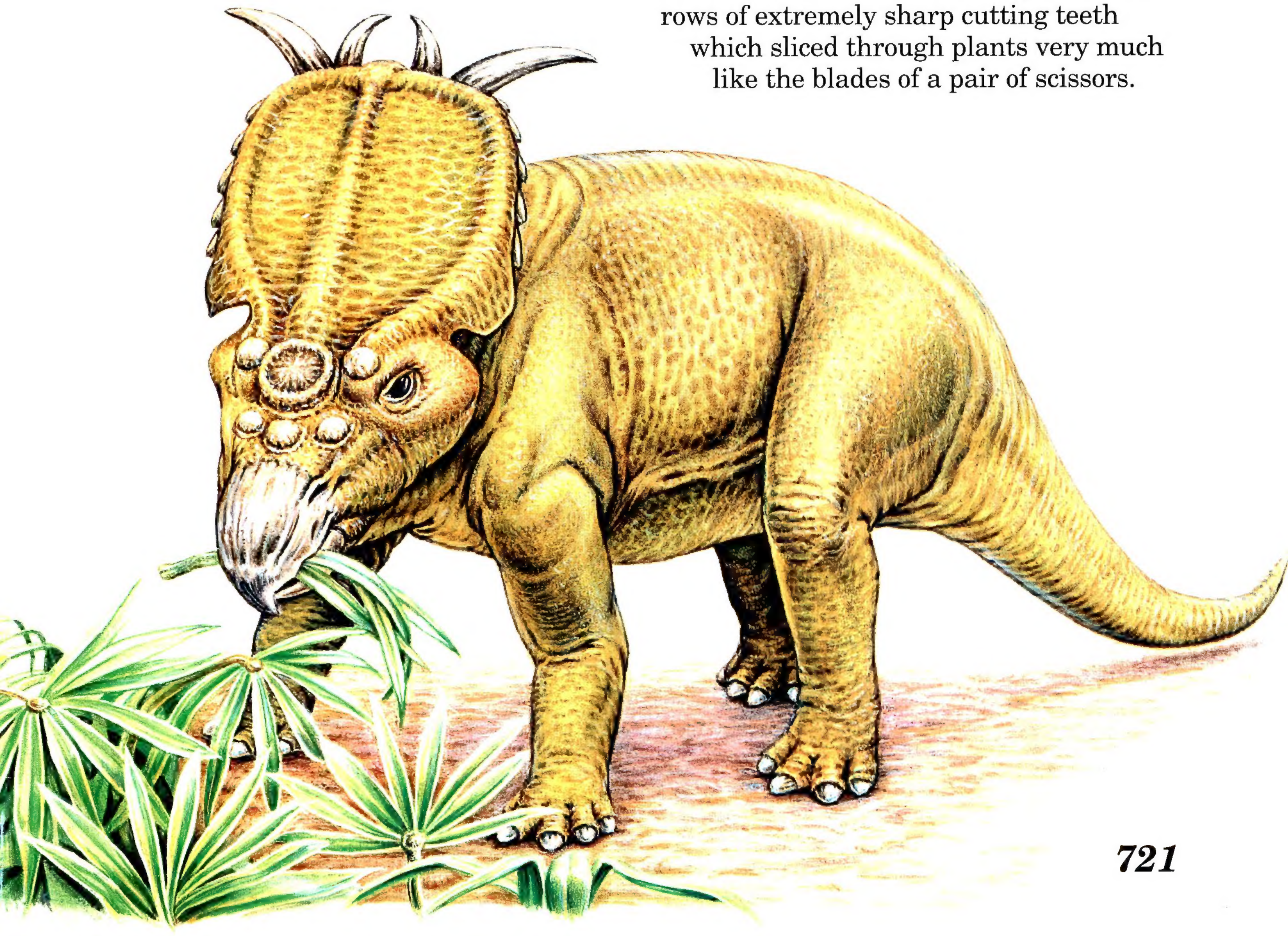
Only two skulls of this unusual horned dinosaur are known. Like many other ceratopids, its skeleton was found in the Late Cretaceous rocks of North America. These rhinoceros-like dinosaurs liked to browse peacefully among low-growing plants. But they could be dangerous if threatened by an enemy.

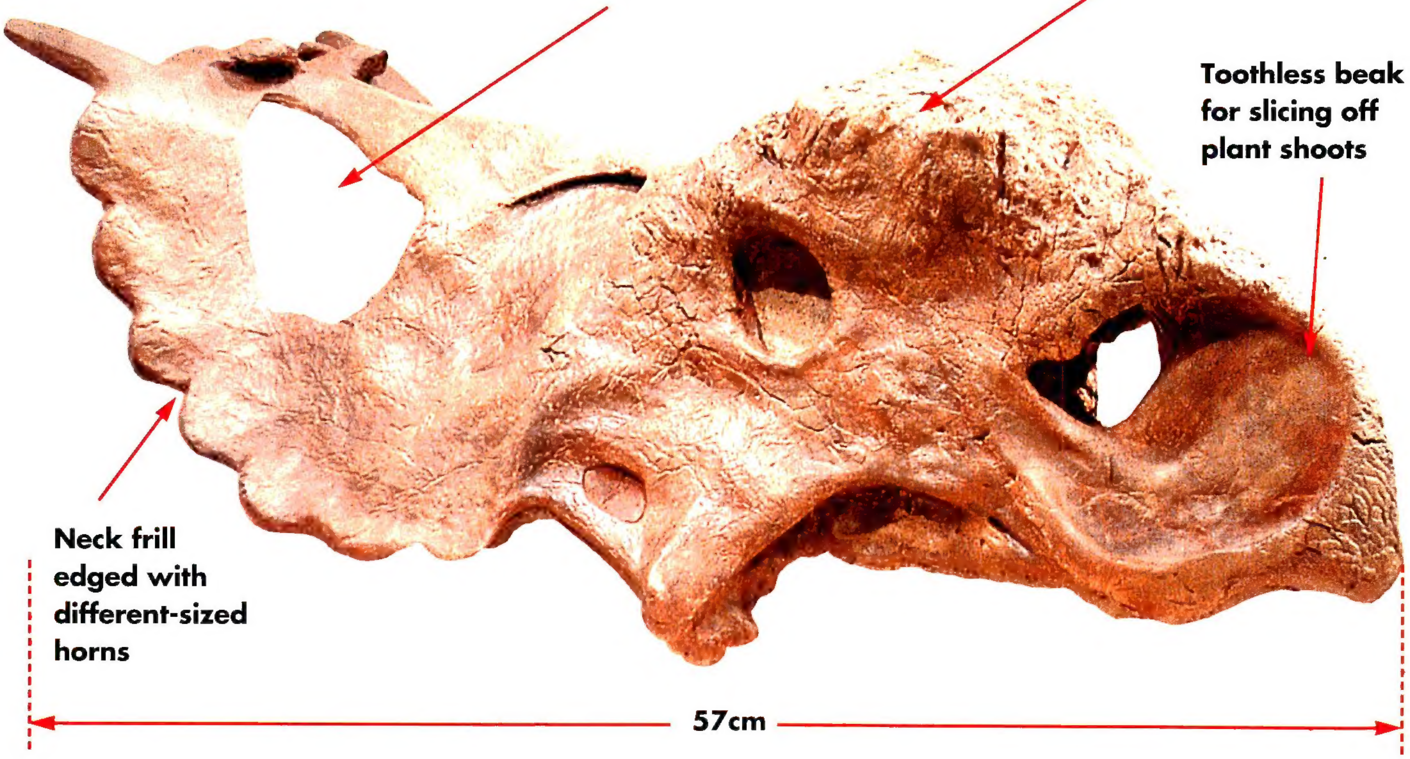
TROPICAL TREATS

The dry, empty plains of Alberta, Canada must have looked very different 75 million years ago. The ground was covered with subtropical plants which grew well in the warm, humid climate. Luckily for *Pachyrhinosaurus* there was plenty to eat. It needed lots of plants to keep going.

PARROT-BEAK

Pachyrhinosaurus fed among the lush undergrowth using its parrot-like, toothless beak to break off tender shoots. Further back inside its jaw, it had rows of extremely sharp cutting teeth which sliced through plants very much like the blades of a pair of scissors.





Window in skull made frill lighter

Rough bony pad along snout probably left after horn had broken off

Toothless beak for slicing off plant shoots

Neck frill edged with different-sized horns

57cm

SHORT-FRILLED

Experts have divided ceratopids into two different groups. One group has long frills and the other, which includes *Pachyrhinosaurus*, has shorter frills. *Pachyrhinosaurus* must have been an impressive sight. Its skull took up a quarter of its whole body length. At the back of the skull stood a neck frill, decorated with a wavy, scalloped edge. At the top of the frill, two short horns curved up and outwards. With its own special frill, *Pachyrhinosaurus* was easily spotted even from a long way away.

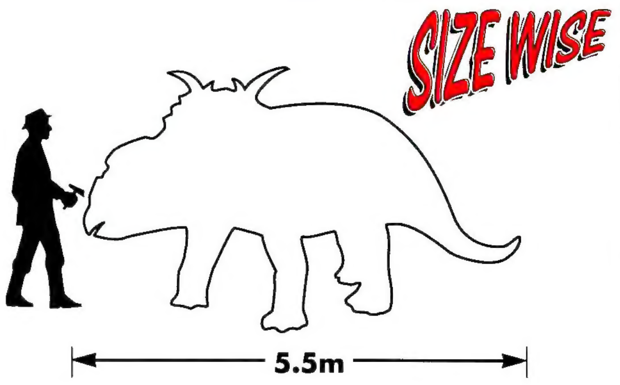
SOMETHING MISSING

Other short-frilled dinosaurs, such as *Centrosaurus* and *Triceratops*, had nose horns near the front of their snouts. But this horn was missing from the *Pachyrhinosaurus* skull. Instead of a nose horn, it had a round, raised lump of bone, shaped rather like a moon crater.

Scientists think *Pachyrhinosaurus* probably did have a horn once, but that it was broken off, perhaps in a tussle with another dinosaur. All that was left was a rough, bony base along the top of the dinosaur's snout.

MONSTER FACTS

- **NAME:** *Pachyrhinosaurus* (pak-ee-rhine-oh-saw-rus) means 'thick-nosed reptile'
- **SIZE:** about 5.5m long
- **FOOD:** plants
- **LIVED:** about 75 million years ago in the Late Cretaceous Period in Alberta, Canada



Is it true that some modern animals have neck frills?

The largest group of reptiles living today, the lizard family, has several frilled members. The Australian frilled lizard has a collar of loose skin which it raises when it wants to look bigger. The regal horned lizard has little horns as well as a spiky neck frill to scare its enemies away.

Two rhinos prepare to fight in much the same way as *Pachyrhinosaurus* would have done.

BIG PUSHOVER

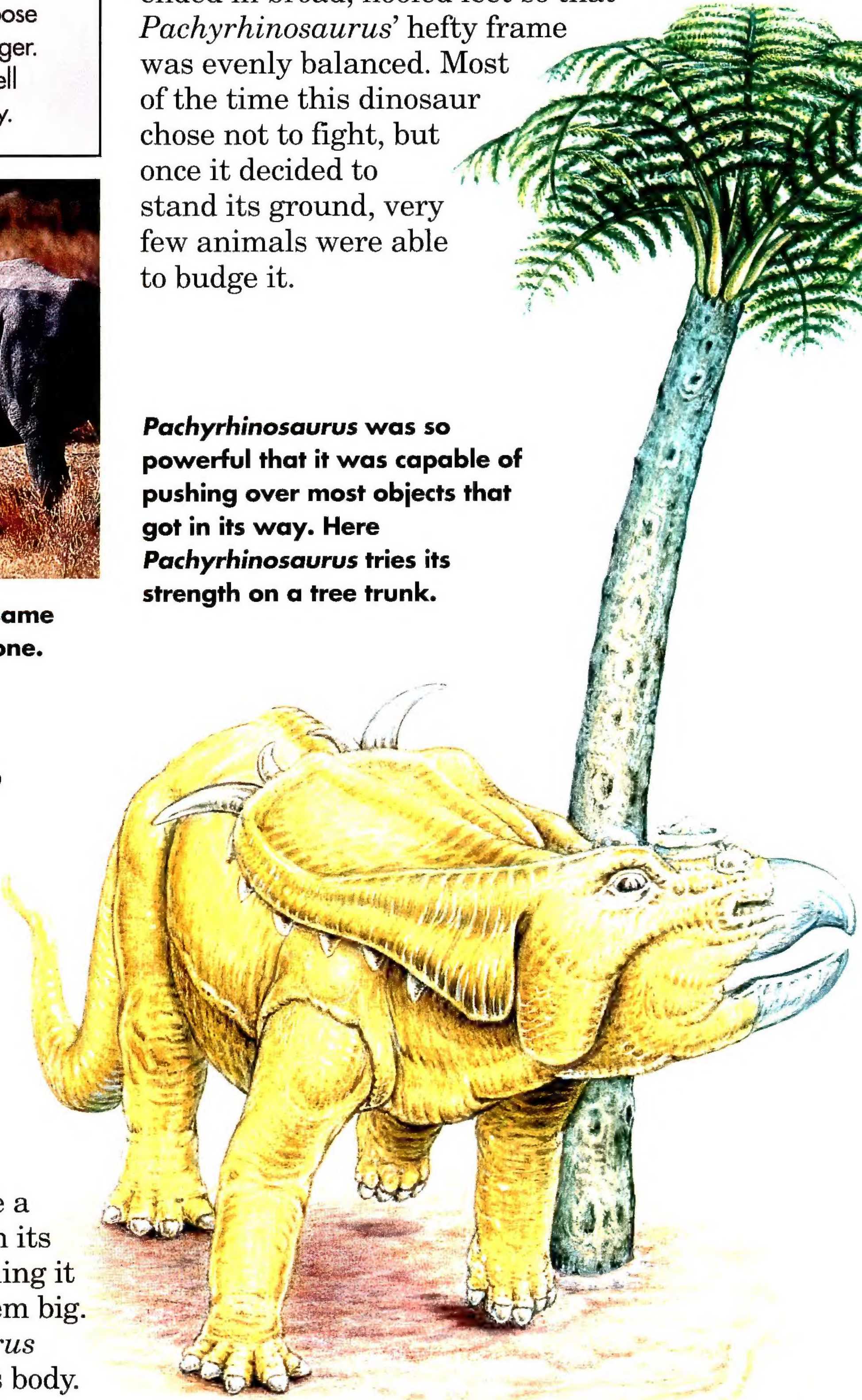
Although it did not have long, sharp horns like some of its relatives, *Pachyrhinosaurus* did have a use for its tough snout. Rivals probably challenged one another in trials of strength, with both dinosaurs pushing their thick bony snouts against each other. The biggest and heaviest probably won and had first choice of a mate.

HEAD WAGGLER

If *Pachyrhinosaurus* did not feel like a fight, it warned predators away with its frill. By lowering its head and waggling it from side to side, it made its frill seem big. If this did not work, *Pachyrhinosaurus* used its head to swipe at its enemy's body.

STOCKY BODY

Pachyrhinosaurus had a large, stocky body and stood on four chunky legs. It needed a strong neck and powerful shoulders to support its heavy head. Its sturdy legs ended in broad, hoofed feet so that *Pachyrhinosaurus*' hefty frame was evenly balanced. Most of the time this dinosaur chose not to fight, but once it decided to stand its ground, very few animals were able to budge it.



***Pachyrhinosaurus* was so powerful that it was capable of pushing over most objects that got in its way. Here *Pachyrhinosaurus* tries its strength on a tree trunk.**

ATLASCOPCOSAURUS

A rare dinosaur from Australia, *Atlascopcosaurus* was constantly in danger from fierce predators.

During the time that carnivores evolved, they became faster and faster. The plant-eater *Atlascopcosaurus* had to keep on its toes and run as fast as its two long legs would carry it in order to survive.

JAW CLUE

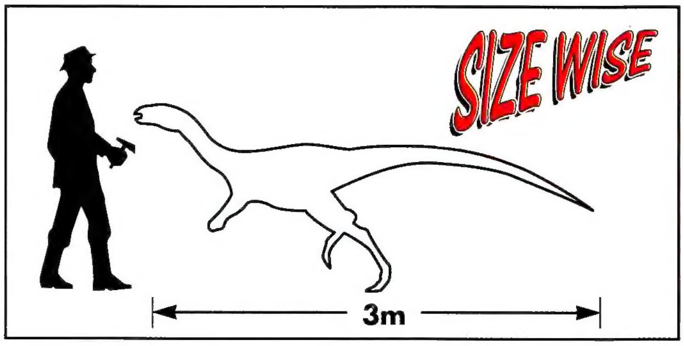
The old mine works at Dinosaur Cove in Australia were probably the first to be excavated just for dinosaurs. Although only a piece of this dinosaur's jaw was found there, experts were able to tell that *Atlascopcosaurus* was a small plant-eater, rather like *Hypsilophodon*.

DANGER SIGNALS

Atlascopcosaurus had a narrow, curved beak which was sharp enough to pluck off juicy vegetation. As it searched for food it also had to keep its eyes open for terrifying predators such as *Allosaurus* and *Megalosaurus*. *Atlascopcosaurus* needed good eyesight and hearing to stay safe.

MONSTER FACTS

- **NAME:** Atlascopcosaurus (at-las-cop-co-saw-rus) means 'Atlas Copco reptile', after the company that made the equipment used to excavate it
- **SIZE:** up to 3m long
- **FOOD:** plants
- **LIVED:** 120 million years ago in the Early Cretaceous Period in south-eastern Australia



NARROW FEET

Like agile *Hypsilophodon*, this dinosaur was lightly built. Its strong leg muscles and narrow feet helped it to build up speed. It ran with its tail held out behind for balance.

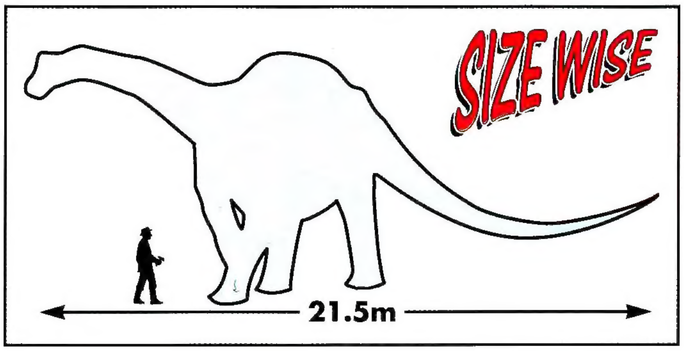
HAPLOCANTHOSAURUS

Long-necked *Haplocanthosaurus* was an enormous dinosaur. It was long enough to touch both ends of a tennis court at the same time!

Experts are not sure what *Haplocanthosaurus* looked like, as its head has never been found. Two incomplete skeletons of a large sauropod were found in Colorado, America at the beginning of this century. It was named *Haplocanthosaurus* by John Bell Hatcher in 1903.

HEAD AND SHOULDERS

Haplocanthosaurus had an unusually long neck with 14 vertebrae. It was even longer than *Camarasaurus* or *Brachiosaurus* neck. Its head was probably short and blunt with thick, chisel-like teeth, ideal for raking leaves from branches.

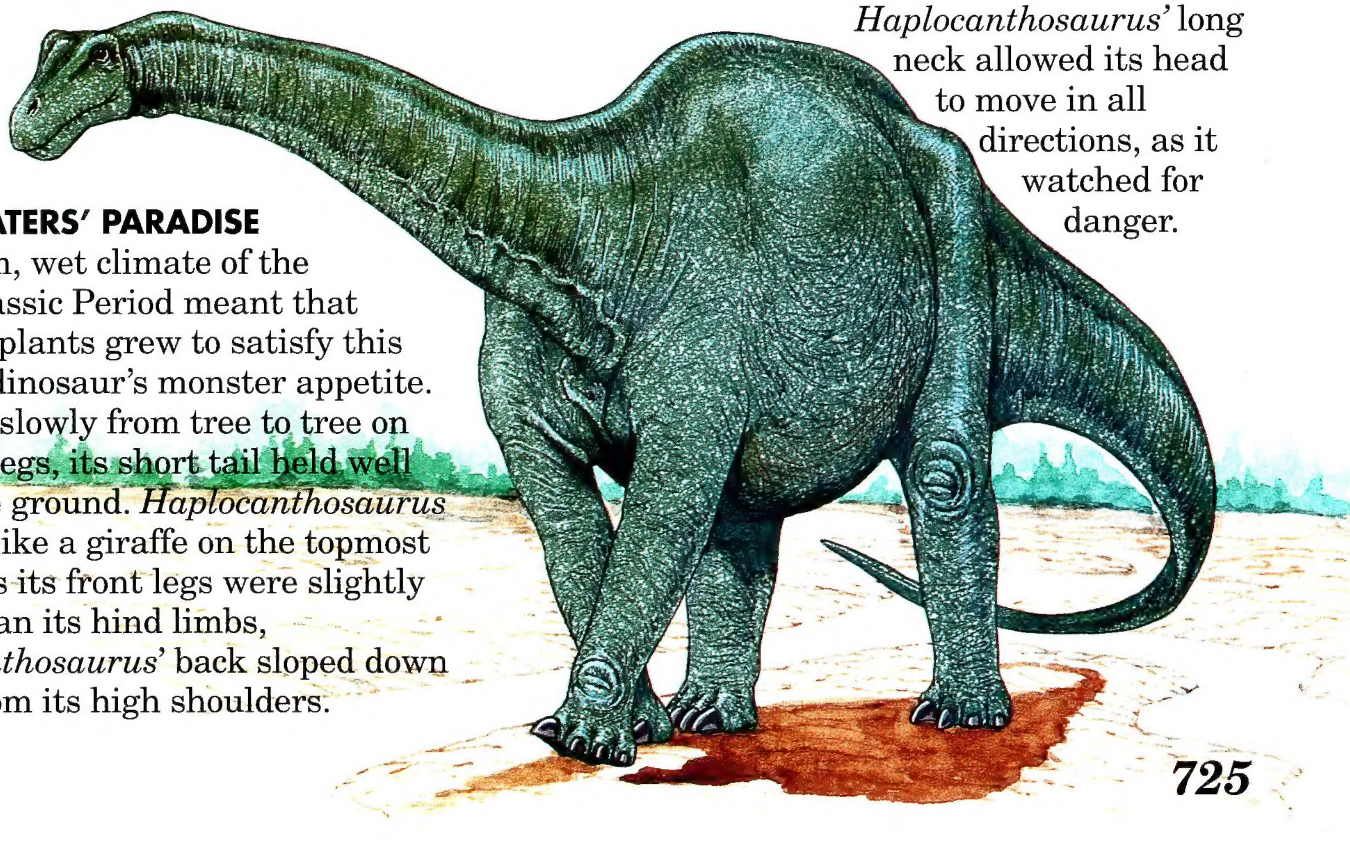


MONSTER FACTS

- **NAME:** *Haplocanthosaurus* (hap-lo-kan-tho-saw-rus) means 'single-spined reptile'
- **SIZE:** up to 21.5m long
- **FOOD:** plants
- **LIVED:** about 145 million years ago in the Late Jurassic Period in Wyoming and Colorado, USA

KEEPING WATCH

Haplocanthosaurus' long neck allowed its head to move in all directions, as it watched for danger.

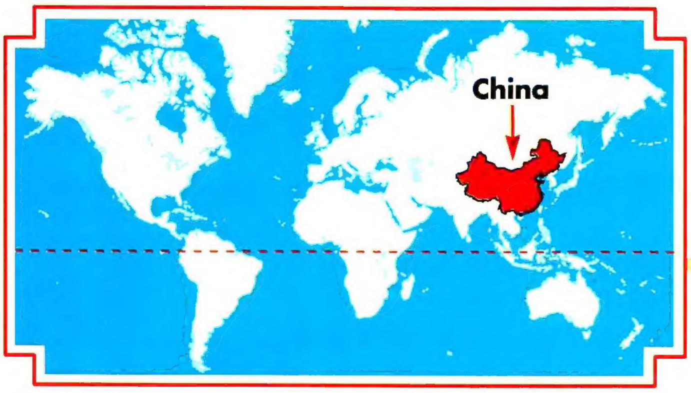


PLANT-EATERS' PARADISE

The warm, wet climate of the Late Jurassic Period meant that plenty of plants grew to satisfy this massive dinosaur's monster appetite. It moved slowly from tree to tree on its thick legs, its short tail held well above the ground. *Haplocanthosaurus* browsed like a giraffe on the topmost leaves. As its front legs were slightly longer than its hind limbs, *Haplocanthosaurus*' back sloped down gently from its high shoulders.

Dinosaurs from China

Dragons or dinosaurs? Fossilized bones found in China have turned out to be dinosaurs of all shapes and sizes.



For people who live in the West, China is a distant and mysterious land. Look at an atlas and see how the huge mountains of the Himalayas separate China from western Asia.

PART OF THE SUPER-CONTINENT

The Himalayas had not formed by the Age of the Dinosaurs. Through the Triassic and Jurassic, China was part of the super-continent of Pangaea, but separated from the main land mass when sea levels rose. There was little to stop the great dinosaur herds wandering to and from China.

THE FIRST FOSSILS

The search for dinosaurs in China began in about 1900. A Russian, General Manakin, collected some dinosaur bones from fishermen in northern China, which led the Russians to mount an expedition.

***Yangchuangosaurus* has *Tuojiangosaurus* in a ferocious and deadly grip from which there seems little chance of escape.**

EXPEDITION DISCOVERIES

The expedition discovered the beautifully preserved skeleton of a duckbilled dinosaur, *Mandschurosaurus*. From then until the 1930s, expeditions from America, France, Sweden and other western countries joined the Chinese in the search for dinosaur remains. During the 1930s, China underwent great political changes and was at war with Japan. Chinese scientists did their own fossil-hunting, but little information reached the West.

ACROSS THE WORLD

An early dinosaur, found in China's Yunnan province, was *Lufengosaurus*. It measured about 5m, with a long neck and tail, and lived 200 million years ago. *Lufengosaurus* was probably a relative of *Plateosaurus* from Europe. So this group of dinosaurs had members right across the world.China also had its share of terrible meat-eaters. One of the earliest of all carnivorous dinosaurs was *Lukousaurus*, a strange member of the coelurosaur group.

SMALL AND SWIFT

Lukousaurus lived in the Late Triassic Period, in southern China. Like its small cousin *Compsognathus*, it was a small, swift dinosaur. It raced about on two legs, and probably chased and caught small reptiles and insects.

BITS AND PIECES

Like dinosaur fossils found in other parts of the world, some of the Chinese remains are very skimpy, while others are marvellously complete. The dinosaur *Szechuanosaurus,* from the Late Jurassic Period, was a two-legged, meat-eater of the theropod type, like *Allosaurus*. At least, experts think it was. Only four of its teeth have been found, shaped and serrated like steak knives. These fossil teeth come from the province of Sichuan in south-east China, which is where the rare giant panda lives today.

WHOLE SKELETONS TOO

Almost the entire skeleton of *Yangchuanosaurus* was found in Sichuan province in 1978. It was another theropod, 10m long and again very similar to *Allosaurus*. In fact *Yangchuanosaurus* had even more teeth than *Allosaurus*, as well as a ridge along its nose.

A dinosaur skeleton is uncovered (below) in the province of Yunnan in 1987. It is an unnamed, 8m long plant-eater from the Jurassic Period.

STRANGE NAMES

Many Chinese dinosaurs are named after the places where their fossils were found. For example, the fossil remains of *Yunnanosaurus* were found in Yunnan province. Dr CC Young, a Chinese palaeontologist, discovered them in the 1940s. *Yunnanosaurus* was a prosauropod, like *Plateosaurus*. But its chisel-shaped teeth were very much like the teeth of its later relative, gigantic *Brachiosaurus* which lived in America and Africa.

LONGEST NECK

Mamenchisaurus was another sauropod, and it is one of China's best-known dinosaurs. Skeletons of this huge *Diplodocus*-type plant-eater were found in the 1950s near a place called Mamenchi. It is most famous for its neck – the longest of any animal. It stretched for 10m, almost half of the dinosaur's entire length.

STRAIGHT AND STIFF

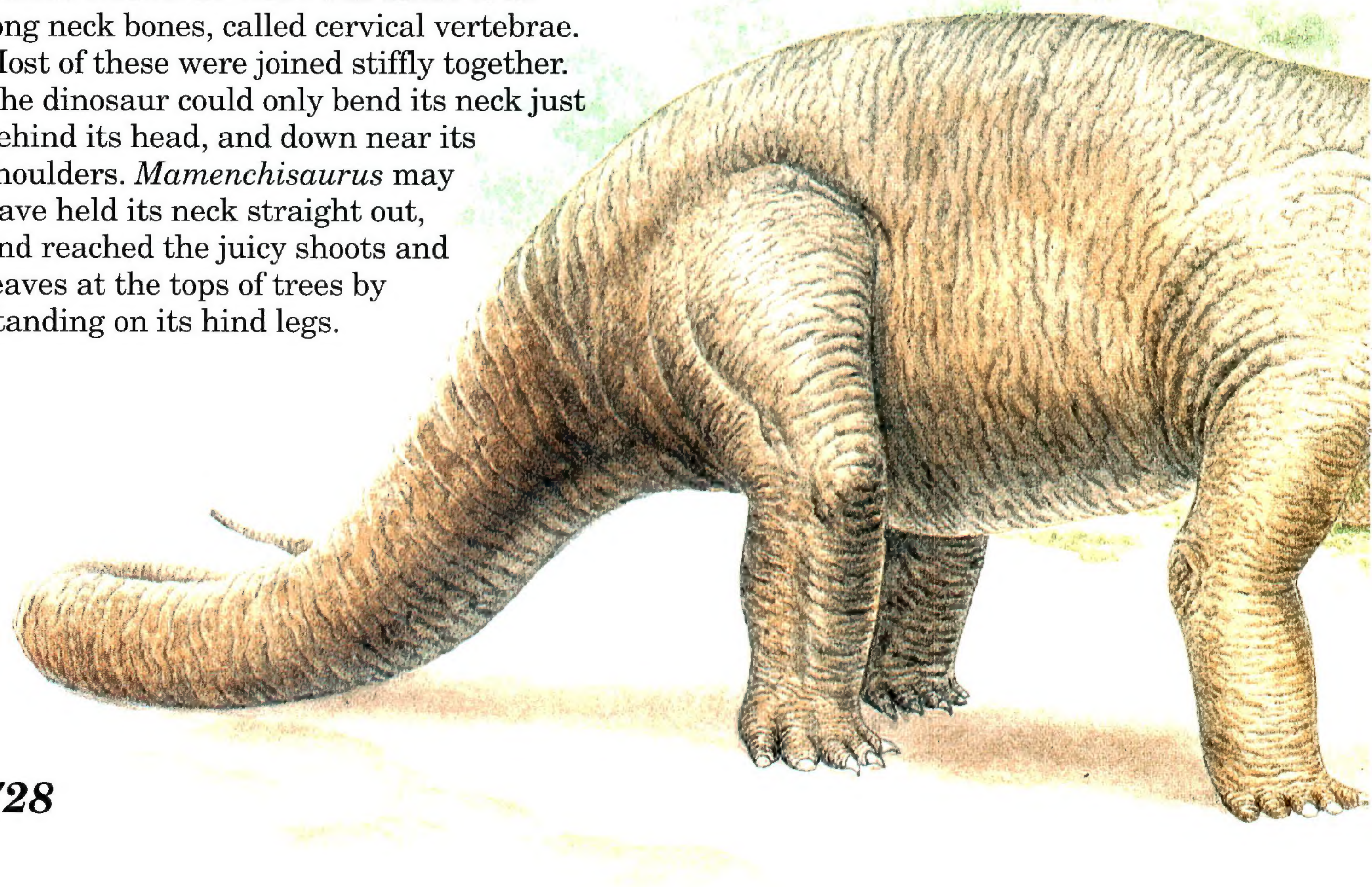
Mamenchisaurus' neck was made of 19 long neck bones, called cervical vertebrae. Most of these were joined stiffly together. The dinosaur could only bend its neck just behind its head, and down near its shoulders. *Mamenchisaurus* may have held its neck straight out, and reached the juicy shoots and leaves at the tops of trees by standing on its hind legs.

GIANTS OF CHINA'S PAST

There were plenty of other massive sauropod dinosaurs in prehistoric China. One was *Omeisaurus*. This dinosaur's fossil skull was toothless, but had sockets for more than 60 teeth! No one knows where the teeth have gone. *Shunosaurus* was an impressive 9m long. *Datousaurus* was even bigger, at 14m. *Zigongosaurus* was a huge relation of *Brachiosaurus*. Its remains were found in Sichuan.

MEMBERS IN CHINA

At the other end of the scale were the fabrosaurids – small, two-legged dinosaurs which munched on plants. They lived in America and Asia during the Early Jurassic. China's fabrosaurids were *Gongbusaurus* and *Xiaosaurus*. China also had its own version of the famous *Iguanodon*. This was *Probactrosaurus*, which was one of the few *Iguanodon*-type dinosaurs to survive to the end of the Cretaceous Period.



Like today's giraffe (above), *Mamenchisaurus* (right) used its long neck to reach tender new shoots which were high above the heads of other animals.

FLOURISHING STEGOSAURS

Some of the most successful dinosaurs in China were stegosaurs. They were similar to *Stegosaurus*, with a small head, heavy body, four stout legs, hoofed toes, and rows of large plates along the back and tail. The first Chinese stegosaur to be discovered was *Tuojiangosaurus*. It was fairly small – only 7m long and 3m high. Like the North American stegosaurs, *Tuojiangosaurus* had a small beak at the front of its mouth, and tiny teeth for nibbling soft plants.

HUGE DUCKBILL

Dinosaurs found in China also include several duckbilled hadrosaurs. In the 1960s a huge duckbill was found in Shandong one of China's provinces. The dinosaur was named *Shantungosaurus*. At 15m long, it was probably the biggest of all duckbills. It thundered along on its back legs, which had hoofed toes. Although it was huge, it was not a hunter. Like all the members of the duckbill family, it ate plants.

EXCITING NEW FINDS

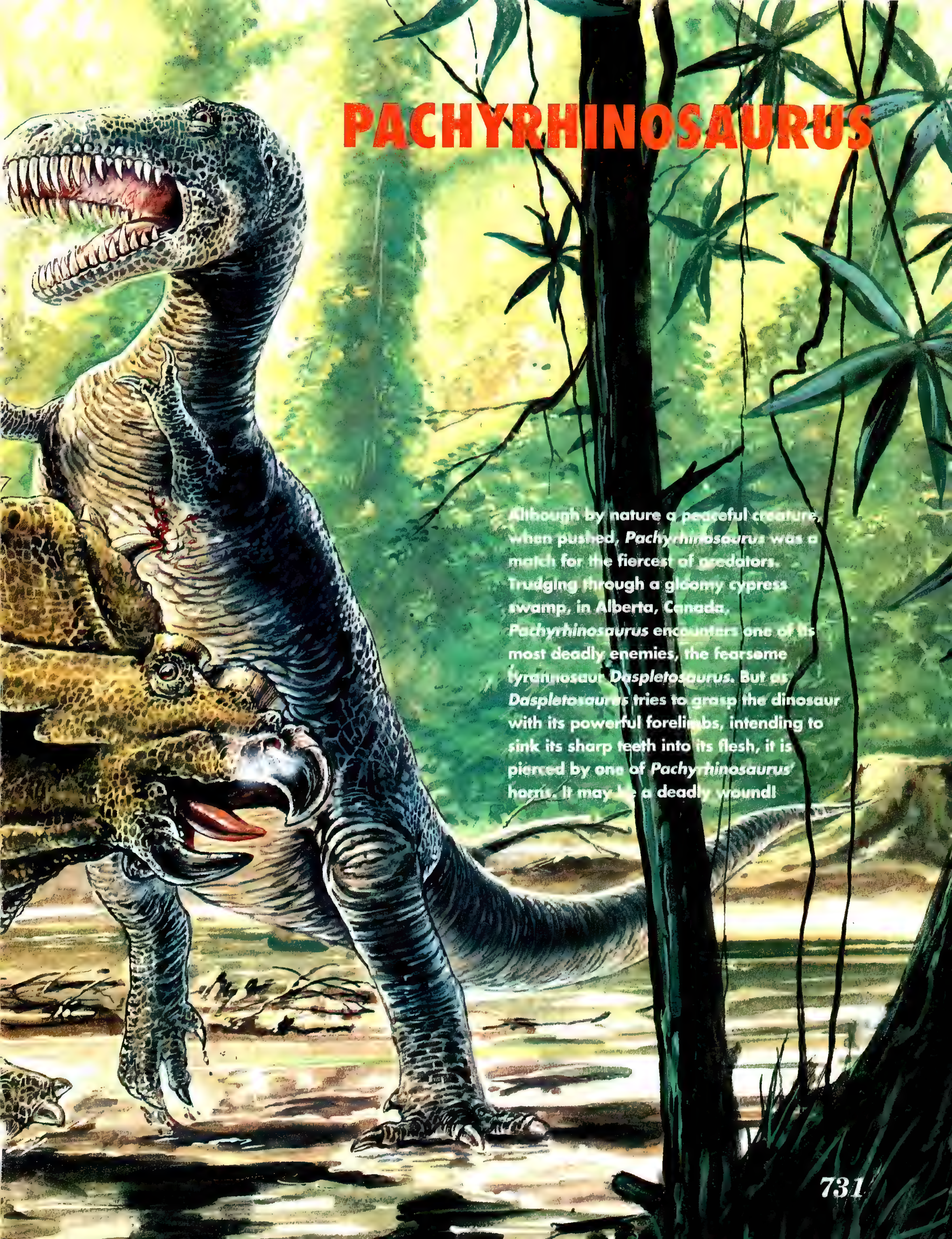
In recent years, there have been expeditions to Chinese fossil sites, by experts from around the world. Many new dinosaurs are being discovered. Sichuan province is one of the most famous places to find Chinese dinosaurs. Beijing Museum, in China's capital city, and Beipei Museum in Sichuan, are wonderful places to see fossils and rebuilt skeletons.

Is it true that dragon's teeth have been found in China?

Chinese people have long told tales about dragons. Some of these stories may have started when they found huge teeth in the ground, over 3,000 years ago. By 2,300 years ago, they had dug up great stone bones, too. These were dinosaur remains. But people did not know about dinosaurs then. They thought that the bones and teeth came from dragons. In legends, dragons have strange powers. So people ground the dinosaur fossils into powders and medicines, which they thought had magical powers to cure illness.

GIANTS OF THE PAST

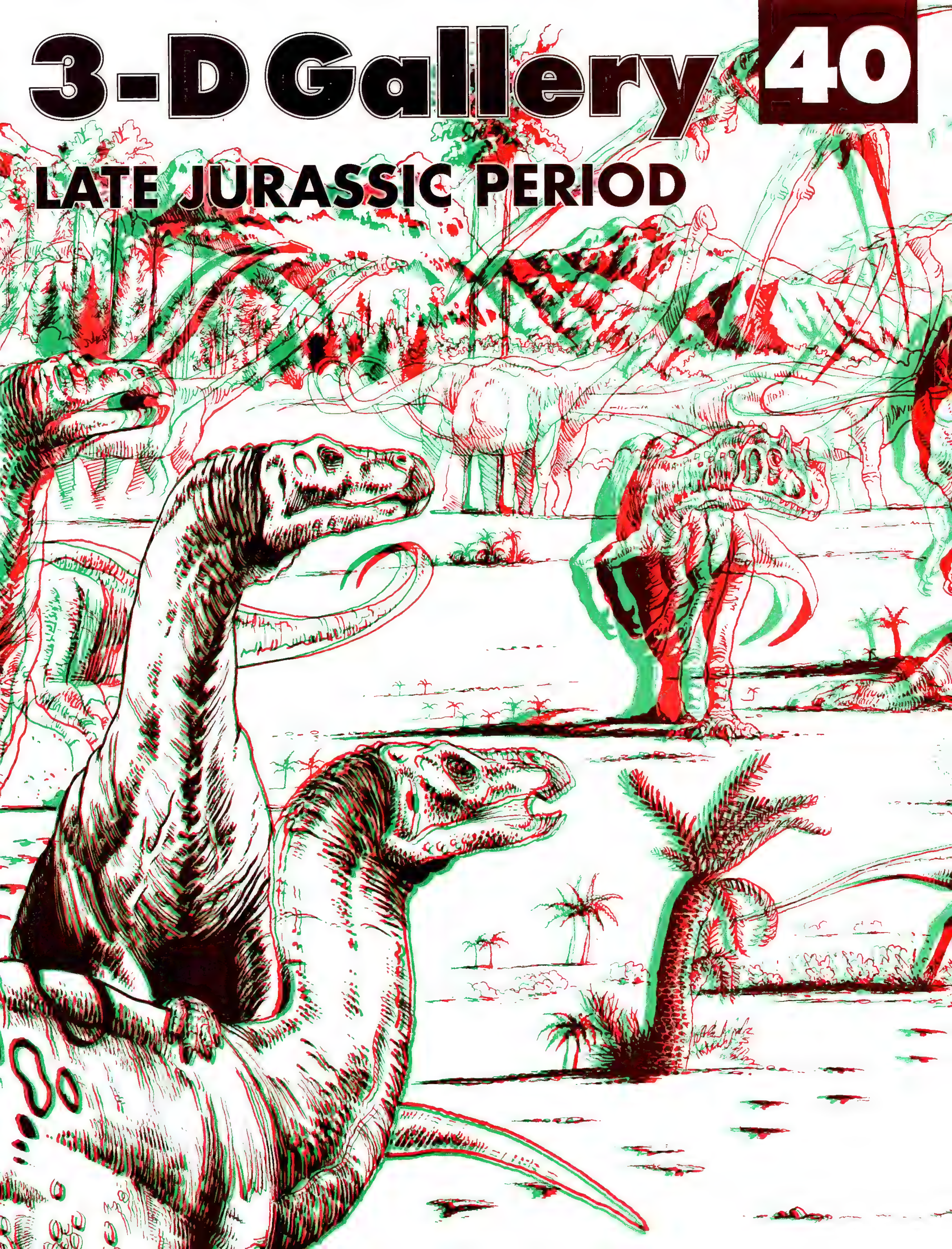
PACHYRHINOSAURUS

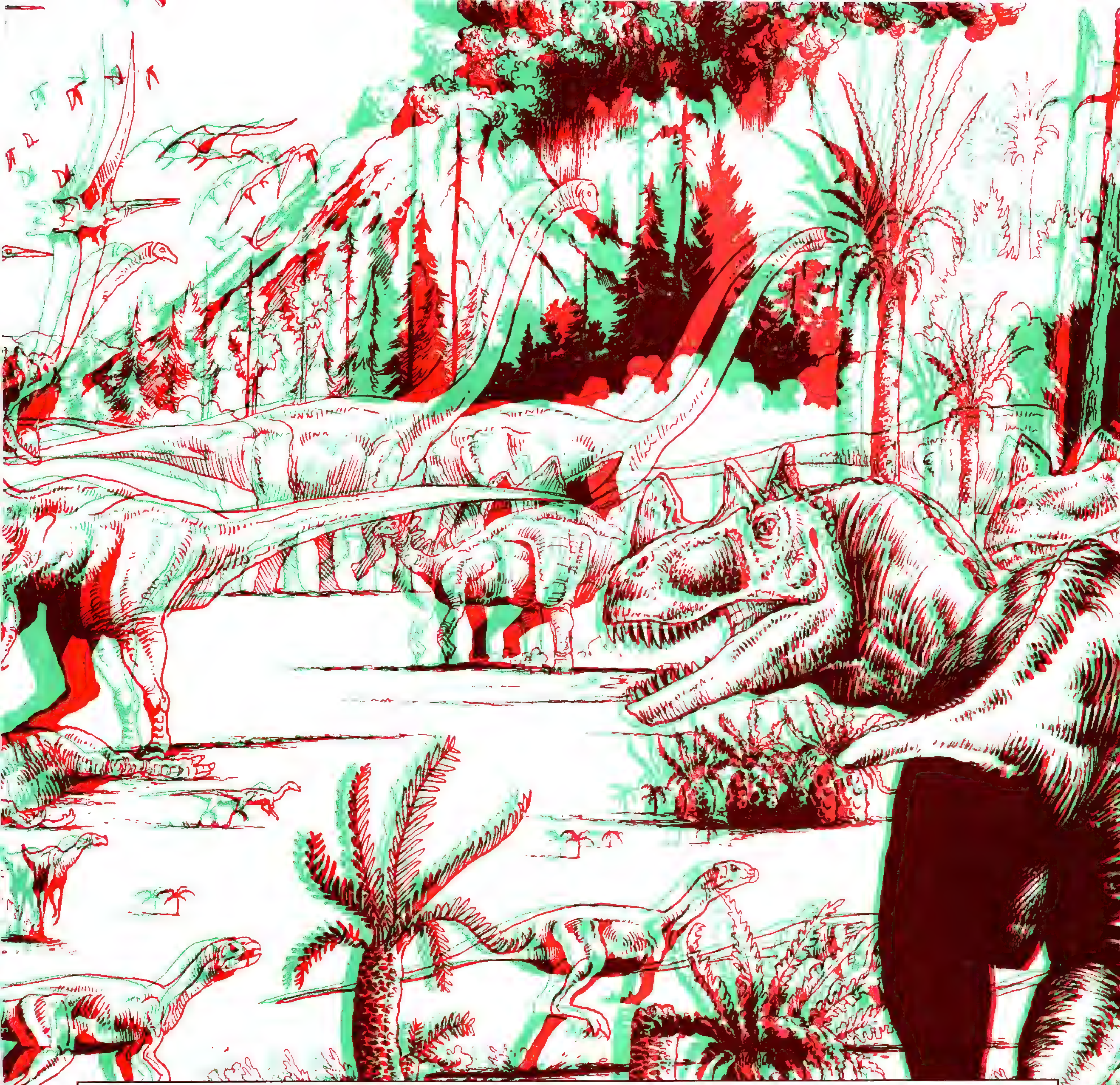


Although by nature a peaceful creature, when pushed, *Pachyrhinosaurus* was a match for the fiercest of predators. Trudging through a gloomy cypress swamp, in Alberta, Canada, *Pachyrhinosaurus* encounters one of its most deadly enemies, the fearsome tyrannosaur *Daspletosaurus*. But as *Daspletosaurus* tries to grasp the dinosaur with its powerful forelimbs, intending to sink its sharp teeth into its flesh, it is pierced by one of *Pachyrhinosaurus'* horns. It may be a deadly wound!

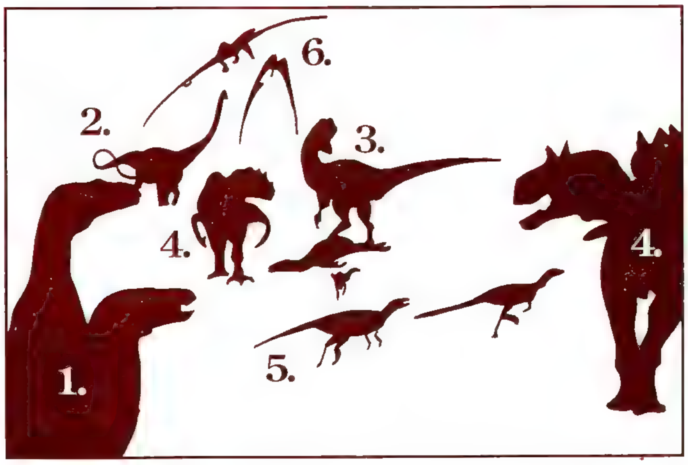
3-D Gallery 40

LATE JURASSIC PERIOD





1. These *Camptosaurus* are always on the lookout for danger.
2. *Diplodocus* looks on, unable to help.
3. *Allosaurus* has just killed a hadrosaur and is warning other dinosaurs to keep away.
4. A group of horned *Ceratosaurus* are ready to steal any leftovers from *Allosaurus'* meal.
5. A pack of *Ornitholestes* run about excitedly.
6. Pterosaurs circle overhead.



Thrilling frills

The sturdy members of the ceratopian family are famous for their frills.

Ceratopians' big, bony collars had several uses. They provided good protection for their vulnerable necks. They attracted mates from the herd. And they could be used to frighten off predators.

ALL SKIN AND BONE

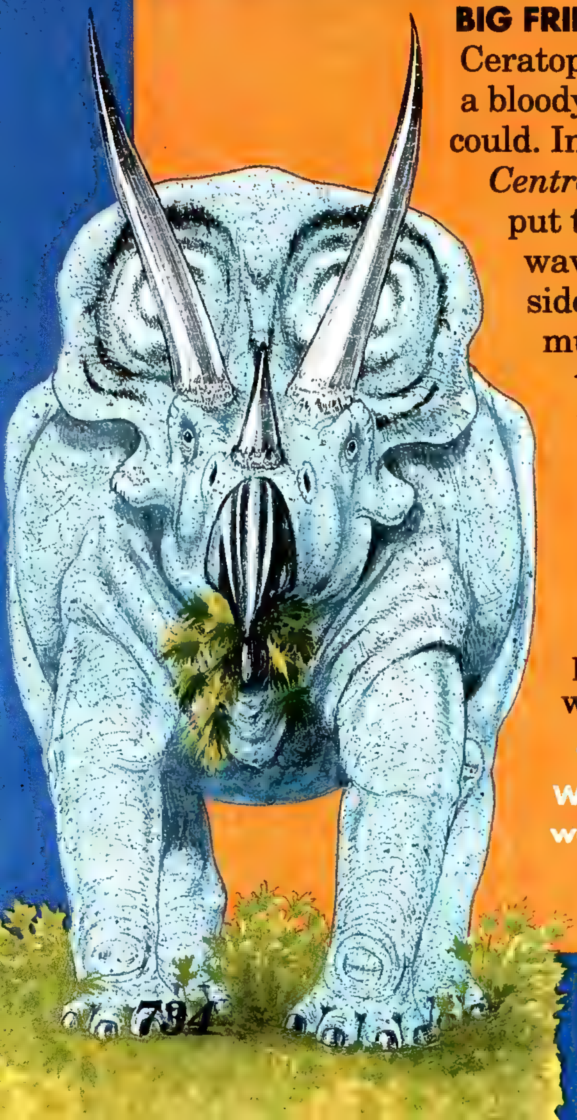
Dinosaur frills were made of bone. Behind the skull, two bones stuck out backwards and formed the frill. These large pieces of bone were covered with skin. Although skin does not fossilize well, experts have found evidence of blood vessels on the frills. They discovered that the blood vessels must have run through the flesh that covered the frill.

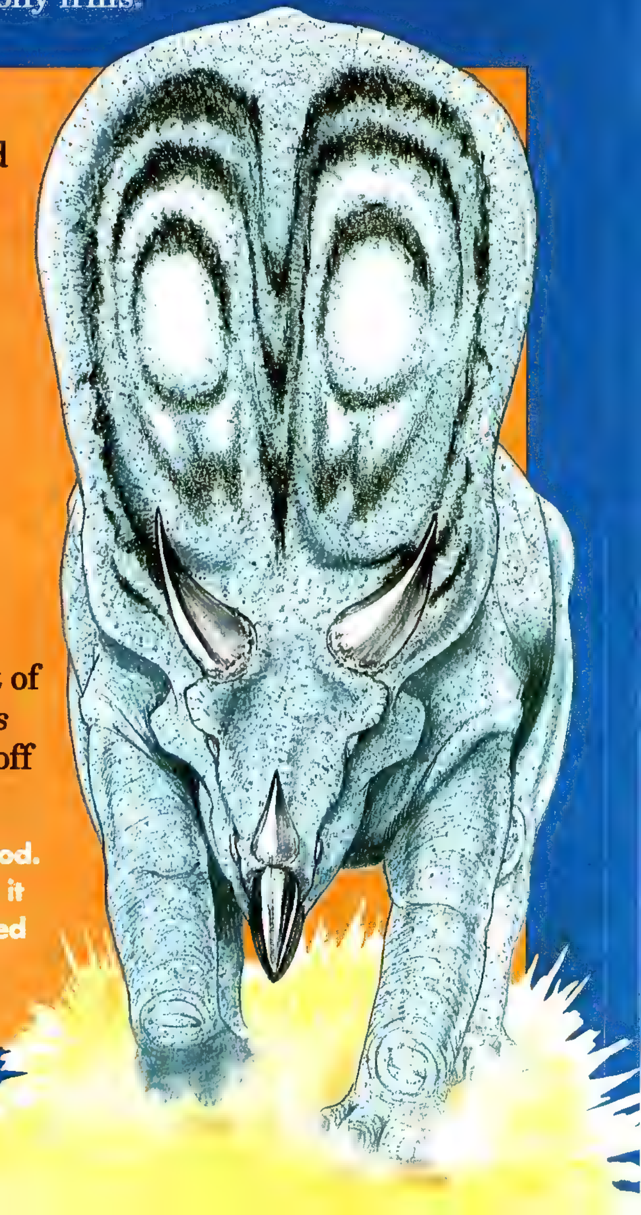
LIGHT SPACES

Imagine having to carry around a huge slab of bone on your shoulders. It would be very heavy and tiring, and would probably slow you down. The horned dinosaurs managed to remain quite agile because most of them had large holes, or windows, in their bony frills.

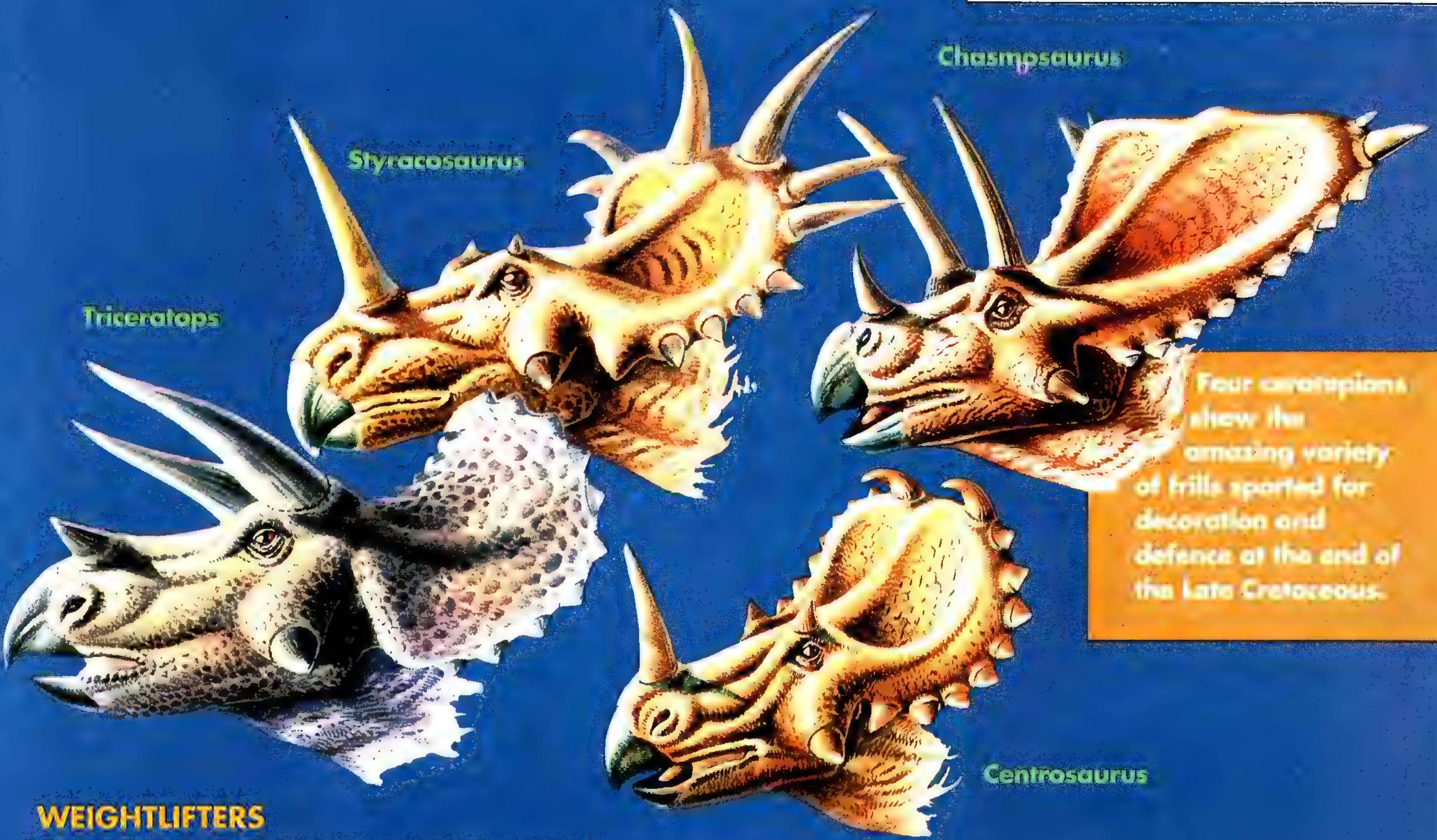
BIG FRILLS

Ceratopians probably tried to avoid a bloody battle whenever they could. Instead, dinosaurs such as *Centrosaurus* and *Torosaurus* put their heads down and waved their frills from side to side. This made them look much larger and more terrifying than they really were. *Styracosaurus* had a strong nose horn, but it didn't use it for fighting, because it would have become damaged with a lot of use. Instead, *Styracosaurus* probably put its opponents off with its huge frill.





***Torosaurus* (left) in peaceful mood. When it was threatened or when it wanted to attract a mate, it ducked its head down and raised its bony frill (right).**



Four ceratopians show the amazing variety of frills sported for decoration and defence at the end of the late Cretaceous.

WEIGHTLIFTERS

Some horned dinosaurs carried around frills that were up to 2.5m long. Their legs were very strong, to help them cope with this tremendous load. Just as Olympic weightlifters need very strong legs to help them lift the weights above their heads, frilled dinosaurs had sturdy front legs to support the weight of their huge skulls. Their necks were also reinforced; the first three neck bones behind their skulls were fused together.

OFF-PUTTING

Longer-frilled dinosaurs almost certainly used their frills for defence. *Triceratops*, *Chasmosaurus*, *Anchiceratops* and *Torosaurus* had such massive frills that they made themselves look really huge. If this didn't put off an attacker, the frill served as a useful shield to protect the dinosaur's weak point, which was its neck. Modern frilled lizards also stick their frills up to make themselves appear much larger than they really are.

ALL DIFFERENT

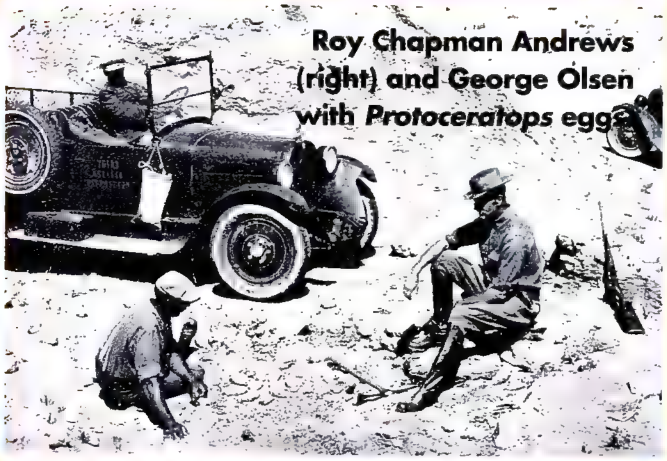
Each kind of horned dinosaur had quite a different frill. Some had lots of big spikes around the frill, others had quite small frills with no spikes at all. Why should they all be so different? Perhaps these frilled dinosaurs used their bony neck collars as a way of recognising their own species. Antelopes and gazelles today have different-shaped horns for a similar reason.

Larger than life: today's frilled lizard from Australia with its frill raised.

Expeditions: MONGOLIA

Some of the best dinosaur fossils were found under the shifting sands of the Gobi desert in Mongolia.

During the 1920s an American collector braved the Gobi Desert to discover that it was one of the richest dinosaur hunting grounds in the world.



Roy Chapman Andrews (right) and George Olsen with *Protoceratops* eggs

THE FIRST EXPEDITIONS

- Led by Roy Chapman Andrews
- To Bayn-Dzak, Mongolia
- In 1922, 1923, 1925, 1928, 1930
- From USA
- Major finds – *Protoceratops'* eggs, *Oviraptor*, *Saurornithoides*, *Velociraptor*

FROM AMERICA

A rush of other dinosaur hunters quickly followed. Roy Chapman Andrews was a dashing explorer determined to reach his goal in the deserts of Mongolia. Many people think the film character Indiana Jones was modelled on him. He wanted to travel deep into the Gobi. But at that time the only way to do it was by camel and that was too slow. So he shipped large cars with extra strong springs over from America.

MODERN SHIPS OF THE DESERT

The 1920s cars made their way across the trackless sand like ships over an ocean. This was the first motorized expedition and it was for the American Museum of Natural History.

Roy Chapman Andrews (far right) looks at a bone with his chief palaeontologist, Walter Granger.

In 1992 an American expedition (below right) retraced Chapman Andrews' footsteps to the famous Flaming Cliffs in the Gobi Desert.

The expedition's fleet of cars was heavily laden, and flew the American flag (above).

A palaeontologist (right) sifts through some of the finds outside his tent.

The Americans quickly discovered the hazards of driving cars through the desert (above).

FIRST FOSSILS

Andrews was the first collector to find dinosaur fossils in Mongolia. His discoveries were also the first to be found anywhere in the whole of eastern Asia. In 1923 Andrews made his most exciting discovery. He found a cluster of *Protoceratops* nests with fossilized eggs still inside. It was the first real proof that dinosaurs laid eggs and the news raced round the world.

RUSSIAN EXPEDITIONS

- **Led by Ivan Efremov**
- **To Bayn-Dzak, Nemegt Basin**
- **In 1946, 1947, 1949**
- **From Russia**
- **Major finds – *Pinacosaurus, Saurolophus***

FROM RUSSIA

Ivan Efremov led three expeditions into the Gobi for Russia's Academy of Sciences. He returned to Andrews' hunting ground. But he also discovered a new graveyard in the Nemegt Basin. The Russians shipped 120 tons of fossils back to Moscow. Their most important find was *Pinacosaurus*.

— **MONGOLIAN-POLISH EXPEDITIONS** —

- **Led by Zofia Kielan-Jaworowska**
- **To Nemegt Basin**
- **In 1964, 1970, 1971**
- **Joint Mongolian-Polish expeditions**
- **Major finds – *Saichania, Prenocephale, Deinocheirus***

Carefully uncovering a *Saurolophus* skeleton with a paintbrush (left).

FROM MONGOLIA AND POLAND

Mongolia's Academy of Science in Ulaan Bataar joined the dinosaur hunters and made a series of expeditions into the Gobi. It shared them with Poland's Academy of Sciences in Warsaw. Their strangest discovery was two huge *Deinocheirus* arms. Nothing more has been found of this dinosaur, but it must have been enormous. This expedition also discovered the entwined fossil bones of *Velociraptor* and *Protoceratops,* locked in battle as they died.

Members of the 1970 Polish-Mongolian expedition (above) kept their heads well covered in the sun.

Left: Polish expedition leader Zofia Kielan-Jaworowska (on left) inside a yurt, or Mongolian tent.

Vehicles in 1970 (below) were better suited to desert conditions.

The Polish-Mongolian camp in 1970 (right) – small tents in a vast bleak landscape.

MONGOLIAN-AMERICAN EXPEDITIONS

- **Team led by Michael Novacek**
- **To Bayn-Dzak, Tugrugeen, Khulsan**
- **19991, 1992, 1993**
- **Joint Mongolian-American expeditions**
- **Major find – *Velociraptor*, *Mononychus***

FROM AMERICA AGAIN

The 1992 Mongolian-American expedition retraced Roy Chapman Andrews' footsteps and broke new ground. It found the fossil bones of *Velociraptor*, and a completely new dinosaur which has been named *Mononychus*.

Malcolm McKenna from the American Museum of Natural History carefully uncovers a new find (right).

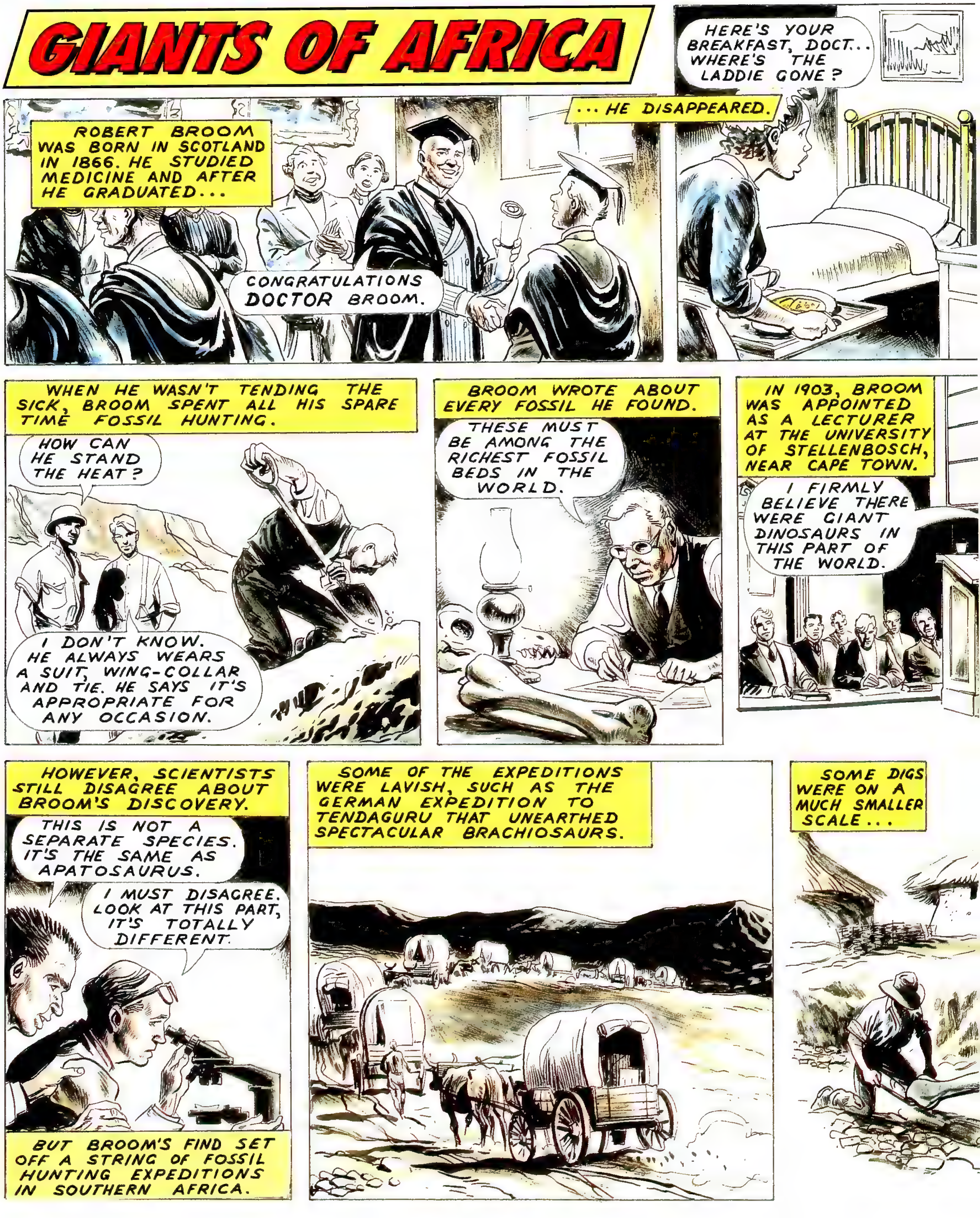
Mark Norrell from the American Museum (right), with *Protoceratops* eggs.

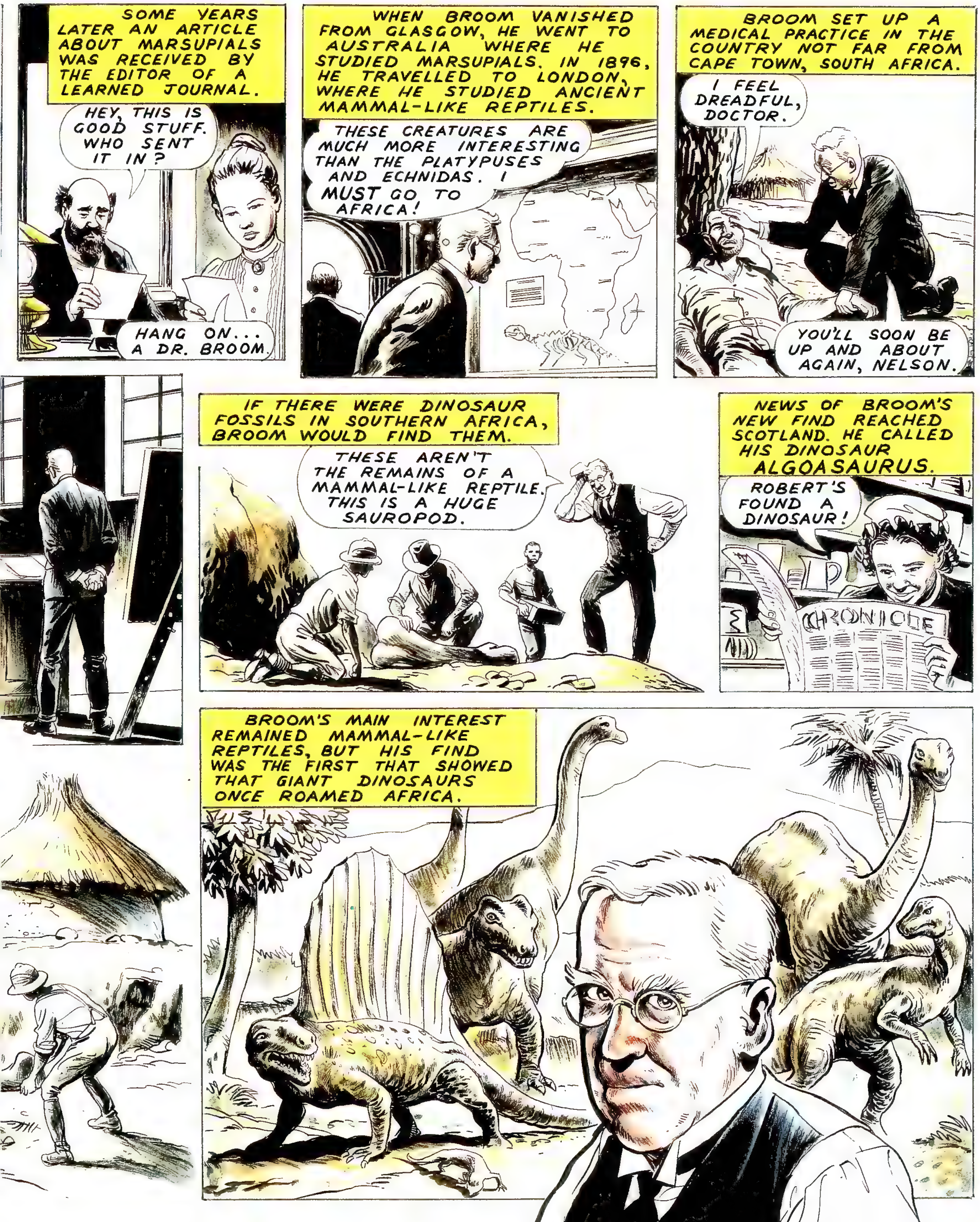
The camp beneath the Flaming Cliffs in July 1992 (below).

Searching for more fossil fragments on an outcrop of the Flaming Cliffs (below).

Expeditions today are just as tough and demanding as they were 70 years ago.

GIANTS OF AFRICA


ROBERT BROOM WAS BORN IN SCOTLAND IN 1866. HE STUDIED MEDICINE AND AFTER HE GRADUATED...
CONGRATULATIONS DOCTOR BROOM.
... HE DISAPPEARED.
HERE'S YOUR BREAKFAST, DOCT... WHERE'S THE LADDIE GONE?
WHEN HE WASN'T TENDING THE SICK, BROOM SPENT ALL HIS SPARE TIME FOSSIL HUNTING.
HOW CAN HE STAND THE HEAT?
I DON'T KNOW. HE ALWAYS WEARS A SUIT, WING-COLLAR AND TIE. HE SAYS IT'S APPROPRIATE FOR ANY OCCASION.
BROOM WROTE ABOUT EVERY FOSSIL HE FOUND.
THESE MUST BE AMONG THE RICHEST FOSSIL BEDS IN THE WORLD.
IN 1903, BROOM WAS APPOINTED AS A LECTURER AT THE UNIVERSITY OF STELLENBOSCH, NEAR CAPE TOWN.
I FIRMLY BELIEVE THERE WERE GIANT DINOSAURS IN THIS PART OF THE WORLD.
HOWEVER, SCIENTISTS STILL DISAGREE ABOUT BROOM'S DISCOVERY.
THIS IS NOT A SEPARATE SPECIES. IT'S THE SAME AS APATOSAURUS.
I MUST DISAGREE. LOOK AT THIS PART, IT'S TOTALLY DIFFERENT.
BUT BROOM'S FIND SET OFF A STRING OF FOSSIL HUNTING EXPEDITIONS IN SOUTHERN AFRICA.
SOME OF THE EXPEDITIONS WERE LAVISH, SUCH AS THE GERMAN EXPEDITION TO TENDAGURU THAT UNEARTHED SPECTACULAR BRACHIOSAURS.
SOME DIGS WERE ON A MUCH SMALLER SCALE...


SOME YEARS LATER AN ARTICLE ABOUT MARSUPIALS WAS RECEIVED BY THE EDITOR OF A LEARNED JOURNAL.
HEY, THIS IS GOOD STUFF. WHO SENT IT IN?
HANG ON... A DR. BROOM.
WHEN BROOM VANISHED FROM GLASGOW, HE WENT TO AUSTRALIA WHERE HE STUDIED MARSUPIALS. IN 1896, HE TRAVELLED TO LONDON, WHERE HE STUDIED ANCIENT MAMMAL-LIKE REPTILES.
THESE CREATURES ARE MUCH MORE INTERESTING THAN THE PLATYPUSES AND ECHNIDAS. I MUST GO TO AFRICA!
BROOM SET UP A MEDICAL PRACTICE IN THE COUNTRY NOT FAR FROM CAPE TOWN, SOUTH AFRICA.
I FEEL DREADFUL, DOCTOR.
YOU'LL SOON BE UP AND ABOUT AGAIN, NELSON.
IF THERE WERE DINOSAUR FOSSILS IN SOUTHERN AFRICA, BROOM WOULD FIND THEM.
THESE AREN'T THE REMAINS OF A MAMMAL-LIKE REPTILE. THIS IS A HUGE SAUROPOD.
NEWS OF BROOM'S NEW FIND REACHED SCOTLAND. HE CALLED HIS DINOSAUR ALGOASAURUS.
ROBERT'S FOUND A DINOSAUR!
CHRONICLE
BROOM'S MAIN INTEREST REMAINED MAMMAL-LIKE REPTILES, BUT HIS FIND WAS THE FIRST THAT SHOWED THAT GIANT DINOSAURS ONCE ROAMED AFRICA.

Improve and test your knowledge with...

DINO Fact File

Hidden treasure

Some cliffs in Normandy, northern France, are a fossil hunter's dream. At the bottom of these chalky cliffs are the remains of Jurassic fossils. But there is a catch! The famous site is under water except for a few hours a year when the tides are unusually low.

Fascinating dinosaur facts to read and 10 fun questions to answer.

1 In which country were *Mamenchisaurus* and *Yunnanosaurus* found?
a) USA
b) France
c) China

2 What does *Monoclonius* mean?
a) clown head
b) one-horned
c) one claw

3 Which dinosaurs are famous for their frills?
a) hadrosaurs
b) sauropods
c) ceratopians

4 *Szechuanosaurus* was a:
a) Chinese dinosaur
b) Chinese scientist
c) Chinese dragon

5 Where did Robert Broom find dinosaur remains?
a) under his house
b) in South Africa
c) in a gold mine

6 What did *Pachyrhinosaurus* have in the middle of its snout?
a) a long horn
b) a bony bulge
c) a third eye

7 *Atlascopcosaurus* was named after:
a) a map of the world
b) a Greek god
c) a machinery company

8 *Haplocanthosaurus* was as long as:
a) a ping pong table
b) a football pitch
c) a tennis court

9 Roy Chapman Andrews travelled over the desert:
a) on camels
b) in cars
c) by hot air balloon

Fragile fossils

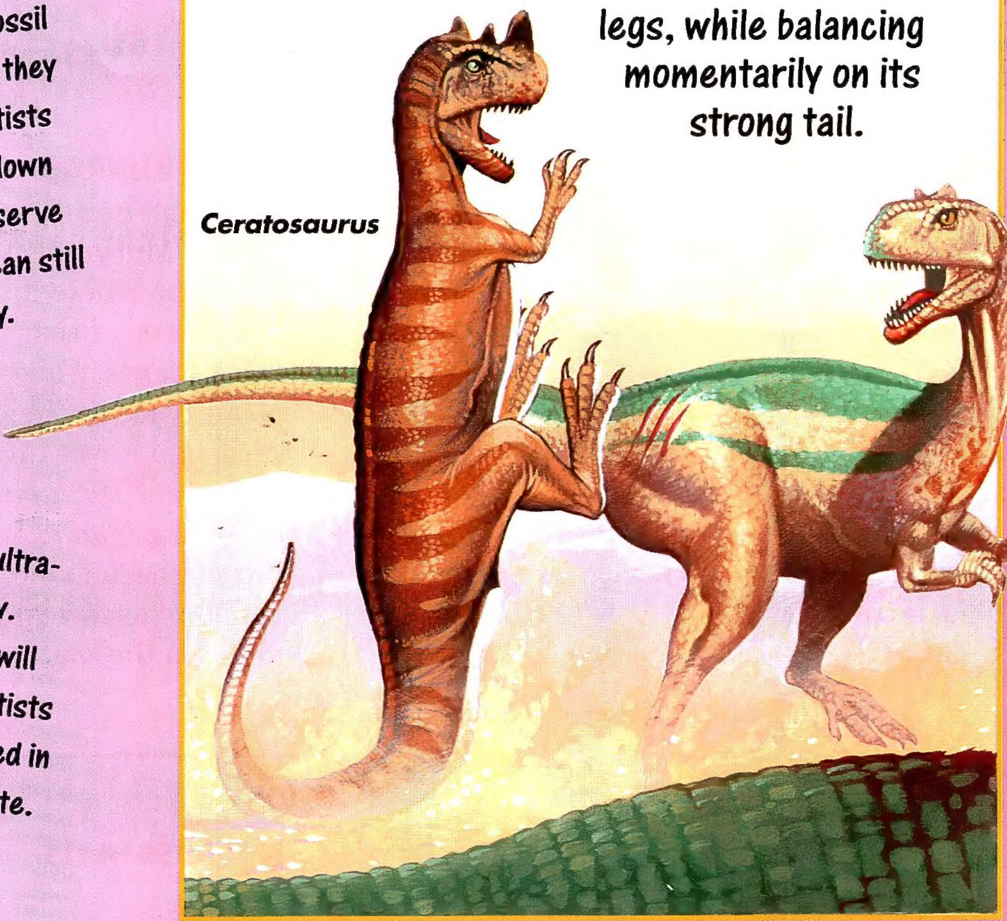
Excavating the fossils of Iguanodon was not the only problem faced by scientists when these dinosaurs were found in a Belgian mine in the 1880s. On their way to Brussels, the fossil bones started to crumble when they were exposed to the air. Scientists stopped them from breaking down completely just in time to preserve them. Visitors to the museum can still see the Iguanodons today.

Fossil detector

Scientists have discovered that ultra-violet light makes a fossil glow. Perhaps one day this technique will save valuable time by telling scientists whether there are fossils embedded in the rock before they excavate a site.

Tall tail?

Ceratosaurus' very thick, muscular tail has led one expert to suggest that it may have used it to prop up its body. Ceratosaurus would have kicked out viciously at its enemies with all four legs, while balancing momentarily on its strong tail.



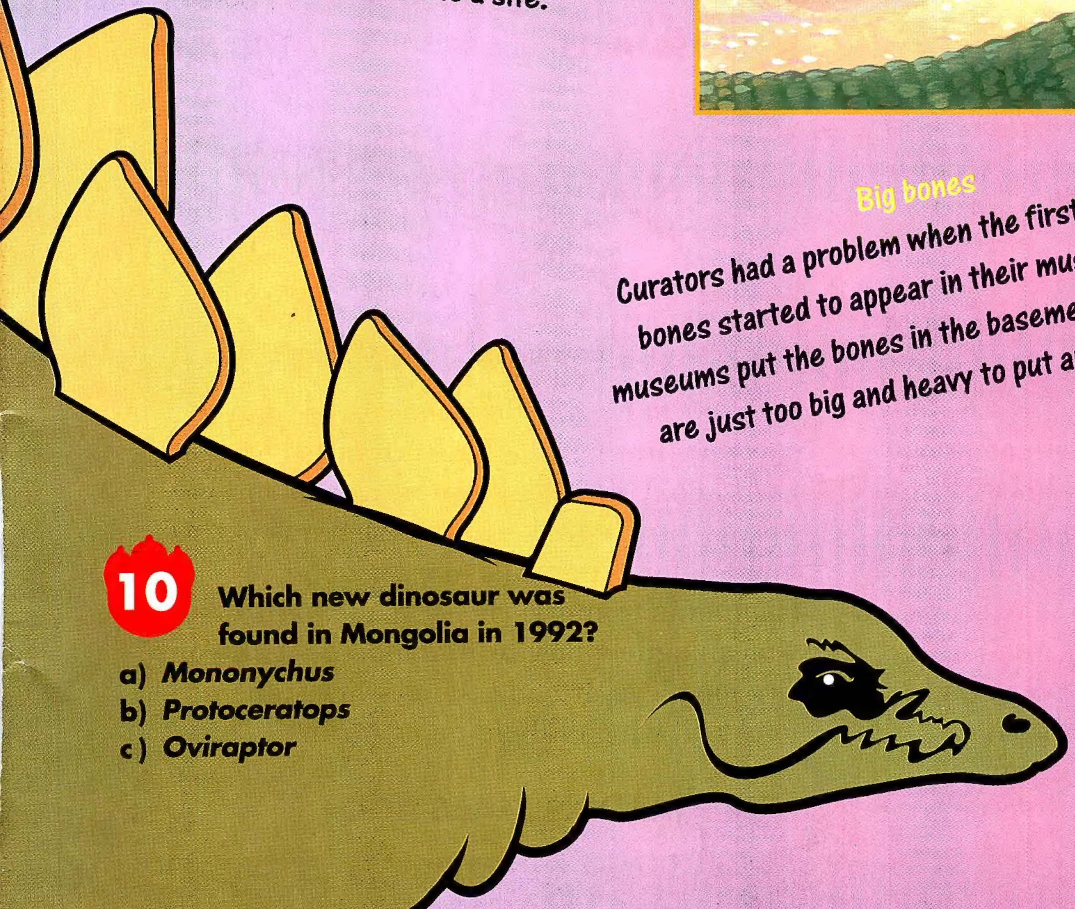
Ceratosaurus

Big bones

Curators had a problem when the first big dinosaur bones started to appear in their museums. Most museums put the bones in the basement because they are just too big and heavy to put anywhere else!

Tongue twister

Try saying Micropachycephalosaurus 10 times quickly! It is the longest name in the dictionary of dinosaurs, but strangely enough, is one of the tiniest dinosaurs ever discovered. Its name means 'tiny thick-headed lizard' and it lived during the Late Cretaceous Period.

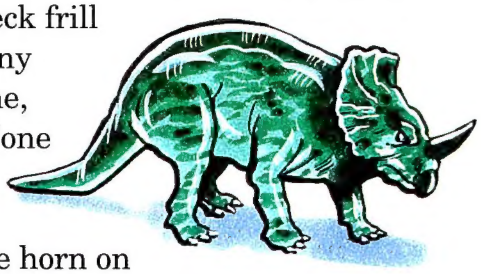


10 **Which new dinosaur was found in Mongolia in 1992?**

- a) *Mononychus*
- b) *Protoceratops*
- c) *Oviraptor*

MONOCLONIUS **80 MYA**

Monoclonius (mon-oh-klone-ee-us) was as long as two small cars. It had a huge head and a short neck frill edged with bony studs. Its name, which means 'one horned', is taken from the single nose horn on its snout. *Monoclonius* looked very like today's rhinoceros. It lived in the Late Cretaceous Period in Montana, USA.

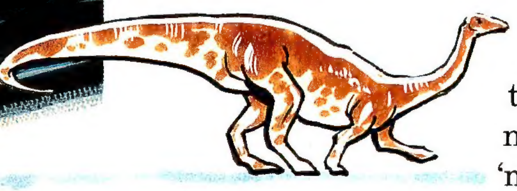


MONTANOCERATOPS **75 MYA**

Montanoceratops (mon-tan-o-ser-a-tops) means 'horned face from Montana'. Similar in size and shape to *Protoceratops*, this plant-eater had a parrot-like beak and a large neck frill. But, unlike its relative, *Montanoceratops* had a sharp nose horn. It was about as long as a large dog and it walked on four pillar-like legs.

MUSSAURUS **200 MYA**

One of the tiniest dinosaurs, *Mussaurus* (muss-aw-rus) lived in the Late Triassic in Patagonia, Argentina. The skeleton found was a baby dinosaur, small enough to fit into the palm of an adult human's hand. Experts think that *Mussaurus* grew to be about the size of a small car. It walked on two or four legs and had a long neck and tail. *Mussaurus'* name means 'mouse reptile'.



MUTTABURRASAURUS **105 MYA**

Muttaburrasaurus (mut-a-bur-a-saw-rus) means 'Muttaburra reptile' after the place in Australia where it was found. It had a low, broad head with a strange bump on its nose. It ate plants, walked on two legs and was about twice the height of an adult human. Although it was an iguanodontid, experts are not sure if *Muttaburrasaurus* had a thumb spike like *Iguanodon's*, as a complete hand has not been found. *Muttaburrasaurus* was a rare find as few iguanodontids have been found in the southern hemisphere.

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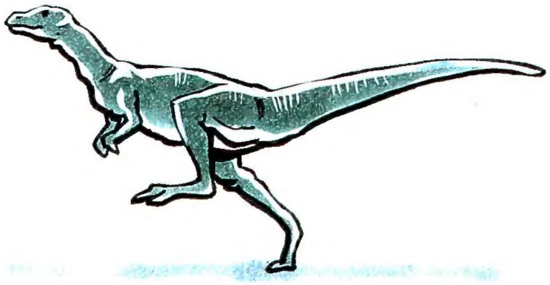
NANOSAURUS **140 MYA**



Only 90cm long, little *Nanosaurus* (nan-o-saw-rus) lived in the Late Jurassic period in Colorado, USA. Not surprisingly, its name means 'tiny reptile'. All that remains of this plant eater is part of a jaw and a few fragments from the skeleton. *Nanosaurus* was an agile dinosaur and moved swiftly on two long legs. It had a slender neck and a long tail, which it held up as it ran.

MYA = MILLION YEARS AGO

COMING IN PART 32 OF

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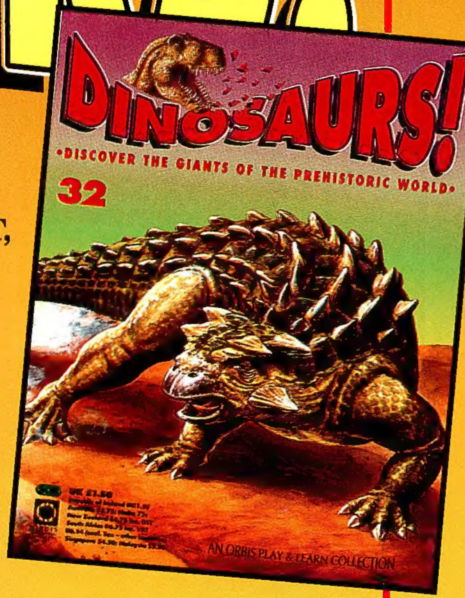
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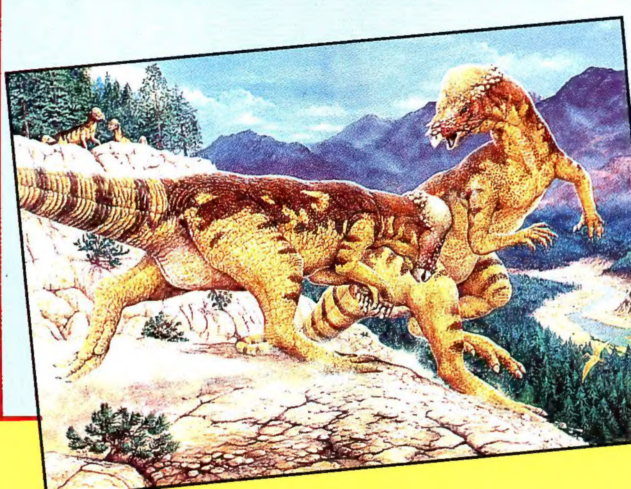

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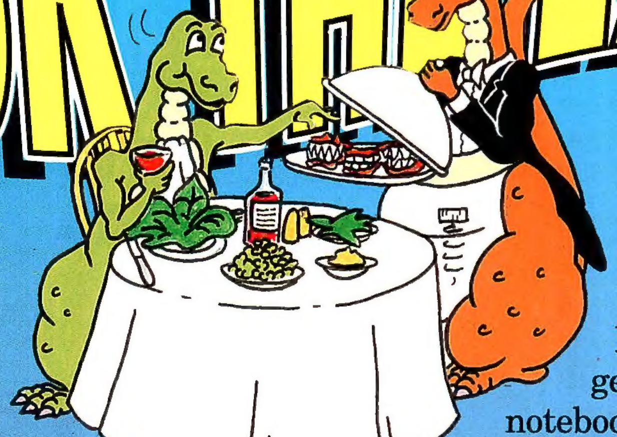
ANSWERS TO DINO FACT FILE QUESTIONS: 1.c 2.b 3.c 4.a 5.b 6.b 7.c 8.b 9.b 10.a

Dr. David Norman of Cambridge University answers your dinosaur questions

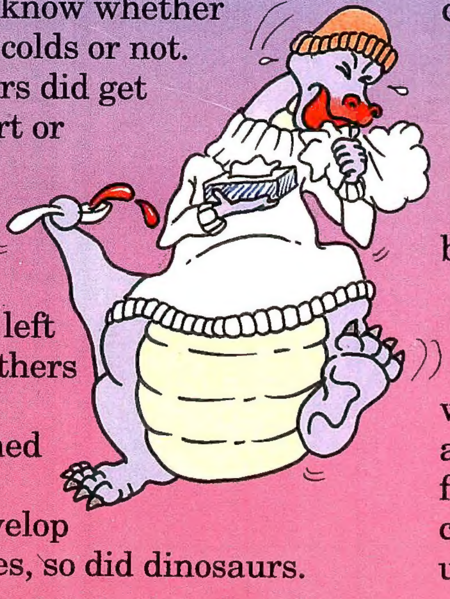
ASK THE EXPERT



Why didn't all plant-eating dinosaurs have the same shaped teeth?

The plant-eaters had different sorts of teeth because they ate many different kinds of plants. For example, the giant sauropods such as *Diplodocus* had small, thin, pencil-like teeth that they used like a rake. Other dinosaurs, such as *Triceratops*, had teeth arranged like scissor blades, which sliced up plants into short lengths. And there were many more types of teeth apart from these, which show that dinosaurs fed on all types of plants in all sorts of ways.

Did dinosaurs catch colds?



We simply do not know whether dinosaurs caught colds or not. However, dinosaurs did get diseases of one sort or another. Some dinosaur bones have been found with the distinctive marks left by cancer, while others show evidence of arthritis or inflamed joints. Just as animals today develop all sorts of illnesses, so did dinosaurs.

What equipment do you need to go fossil-hunting?

Basic equipment includes a geological map, a hammer, a notebook and pencil, brushes, old newspapers, bags, glue or hardener to protect exposed fossils – and a rucksack for carrying everything. You also need a hard hat (in case of falling rock), goggles (against sharp splinters of rock), gloves (to wear while hammering), heavy walking boots (to protect your feet) and tough clothes. Cliffs, quarries and road cuttings are dangerous places, so do not visit them without getting help and advice from experts first – contact your local museum or geology club.

Why are dinosaurs often discovered near the sea?

Dinosaur bones are often found near the sea, embedded in cliff faces. This is because the rocks which form the cliffs often date back as far as the Age of the Dinosaurs.

The sea wears the rock away, and new fossils are constantly uncovered.

31

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